REMARKS

Claims 1-66 are pending in the present application. Claims 1, 2, 18, 22, 34, 38, 48, 52, and 60 are the independent claims under consideration. All of the claims stand rejected under 35 U.S.C. §112 and 35 U.S.C. §102(b). By the present amendment, Applicants have canceled claims 6 and 40, and have amended claims 1 - 5, 7, 9, 10, 13, 15, 16, 18 - 20, 22, 28, 33, 34, 36, 38, 39, 41, 48 - 52, 54, 56, 57, 60 and 63 to overcome the rejection under 35 U.S.C. §112 and to more distinctly claim the subject matter Applicants regard as the invention. Reconsideration in light of the present amendment is respectfully requested.

Claims 1 - 66 were rejected under 35 U.S.C. §112 as being indefinite due to a lack of antecedent basis in a number of claims. By the present amendment, Applicants have amended the claims in order to provide the required antecedent basis.

The Examiner also objected to the title of the invention as being not descriptive. By the present amendment, Applicants have changed the title of the invention to "Sensor For Measuring Out-Of-Plane Acceleration", which Applicants believe is descriptive of the invention.

The Present Invention

The present invention relates to a sensor, such as an accelerometer, for measuring out-of-plane motion. In a preferred embodiment of the invention, a silicon wafer is etched to form a fixed portion, a movable portion, and a resilient coupling between the fixed and movable portions, each generally arranged in the plane of the wafer. One of the fixed and moveable portions including a first electrode, and the other of the fixed and moveable portions includes a second electrode.

The present invention includes two salient features that are not taught or suggested in the reference cited by the Examiner. First, the accelerometer of the invention is

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designed to measure movement outside the plane in which the fixed and moveable electrodes are formed. To accomplish this, the resilient coupling is designed (i) to retain the electrodes in capacitive opposition to each other across a capacitance gap while allowing motion of the first electrode relative to the second electrodes in response to acceleration along an axis of acceleration perpendicular to the plane of the wafer, and (ii) to resiliently restore the first electrode to an equilibrium position relative to the second and third electrodes when the acceleration ceases.

A second important feature of the invention is that one of the fixed and moveable portions comprises a third electrode formed as an electrically conductive layer mechanically coupled with the second electrode. The second and third electrodes are stacked in a direction parallel to the axis of acceleration and arranged in capacitive opposition to the first electrode. The first and second electrodes are arranged in direct capacitive opposition and the first and third electrodes are arranged in indirect capacitive opposition. The capacitance between the first electrode and third electrode increases as the movable portion moves away from the equilibrium position in a direction along the axis of acceleration and decreases as the movable portion moves in an opposite direction away from the equilibrium position.

As discussed in detail below, neither of these features is taught or suggested by the reference cited by the Examiner.

Rejection Under 35 U.S.C. § 102(b)

Claims 1-66 were rejected under 35 U.S.C. § 102(b) as being anticipated by Petersen, et al., U.S. Patent No. 6,084,257 ("Petersen"). Petersen relates to a semiconductor sensor that includes a first single crystal silicon wafer layer bonded to a carrier. First and second beams depend from the first layer and are suspended over a recessed region of the carrier such

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that the beams can move relative to the carrier. In operation, each of the two beams deflects in the plane of the first layer but cannot deflect in a direction generally perpendicular to the plane of the first layer. This ability to flex in the plane of the first layer but not out of the plane of the first layer results from the aspect ratio of the beams, which is at least 5:1.

As discussed above, the present invention includes two features that are not taught or suggested in Petersen. First, the accelerometer of the invention is designed to measure movement outside the plane in which the fixed and moveable electrodes are formed. To accomplish this, the resilient coupling is designed to allow motion of the first electrode relative to the second electrode in response to acceleration along an axis of acceleration perpendicular to the plane of the wafer.

Not only does Petersen not teach or suggest this limitation, but also Petersen unequivocally teaches away from the invention. While Petersen teaches the use of first and second beams suspended over a recessed region of the carrier, each of the two beams deflects in the plane of the first layer but cannot deflect in a direction generally perpendicular to the plane of the first layer. This is clearly shown in the specification in several different areas:

> "In operation, each of the two beams deflect in the plane of the first layer **22** as indicated by arrows **22'** but cannot deflect in a direction generally perpendicular to the plane of the first layer **22** as indicated by arrows **22"**. This ability to flex in the plane of the first layer **22** but not out of the plane of the first layer **22** results from the aspect ratio of the beams . . . ." (Column 3, Lines 45-52)

> "The aspect ratio (vertical height/horizontal width) of the beam is large enough such that it can deflect in the plane of the first layer **72** indicated by arrow **72'** but cannot deflect out of the plane of the layer **72** indicated by arrow **72"**. The processing techniques, described below, permit the fabrication

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of a beam with an aspect ratio of at least 20:1."
(Column 4, Lines 33-38)

Petersen is clearly designed so that it "cannot deflect out of the plane of the layer" in which the electrodes are formed. This is contrary to the present invention, in which fixed and movable electrodes are designed to measure movement outside the plane in which the fixed and moveable electrodes are formed.

A second important feature of the invention is that one of the fixed and moveable portions comprises a third electrode formed by an electrically conductive layer mechanically coupled with the second electrode. The second and third electrodes are stacked in a direction parallel to an axis of acceleration and arranged in capacitive opposition to the first electrode. The first and second electrodes are arranged in direct capacitive opposition, and the first and third electrodes are arranged in indirect capacitive opposition.

In contrast, the Petersen device includes only two electrodes, not the three electrodes used in the current invention. Moreover, in the present invention the first and third electrodes are arranged in indirect capacitive opposition. In other words, rather than being directly opposed from each other the electrodes are indirectly facing each other. Since Petersen does not teach or suggest either (i) use of a third electrode, or (ii) use of electrodes indirectly facing each other, Applicants submit that the present invention is clearly patentable over Petersen.

Finally, Applicants respectfully assert that the amendments made herein have not been made in order to secure patentability of the invention, but only to clarify the language of the claims. Each of the novel features of the invention discussed herein were included in the independent claims prior to the present amendments.

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CONCLUSION

For the foregoing reasons, Applicants believe that the present invention is in condition for allowance and respectfully request such action.

Certificate of Facsimile Transmission

I, David M. Klein, herby certify that this correspondence is being facsimile transmitted to the United States Patent & Trademark Office on March 16, 2004.

Respectfully submitted,

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